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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/942,038	08/30/2001	Yoshihiro Mori	0819-0637	7302

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EXAMINER
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HUYNH, YENNHU B

ART UNIT	PAPER NUMBER
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2813

DATE MAILED: 08/16/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

09/942,038

Applicant(s)

MORI ET AL.

Examiner

Yennhu B. Huynh

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 27 April 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 38-59 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 38-59 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

**DETAILED ACTION*****Continued Examination Under 37 CFR 1.114***

A request for continued examination under 37 CFR 1.114 was filed in this application after appeal to the Board of Patent Appeals and Interferences, but prior to a decision on the appeal. Since this application is eligible for continued examination under 37 CFR 1.114 and the fee set forth in 37 CFR 1.17(e) has been timely paid, the appeal has been withdrawn pursuant to 37 CFR 1.114 and prosecution in this application has been reopened pursuant to 37 CFR 1.114. Applicant's submission filed on 4/27/04 has been entered.

***Election/Restrictions***

Claims 1-9 withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a non-elected claim, there being no allowable generic or linking claim.

Election was made without traverse in Paper No. 7.

Claim 10 has been canceled by Amendment filed on 10/29/02.

Claims 11-37 are cancelled by the Amendment filed on 7/21/03.

Newly added claims 38-59.

***Drawings***

The proposed drawing correction and/or the proposed substitute sheets of drawings, filed on 10/29/02 has been accepted.

### ***Specification***

The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The title has been changed as follows: Method For Fabricating Semiconductor Device Including Annealing Lower Electrode In A Reducing Atmosphere Before Capacitor Insulating Film Forming.

### ***Claim Objections***

Claims 38,44 45 & 52-59 are objected to because of the following informalities:

The recited limitation --capacitive insulating film-- should be changed to --capacitive dielectric film--

Appropriate correction is required.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 38,39,44-46,48,52,55 & 60 are rejected under 35 U.S.C. 102(e) as being anticipated by Fujiwara et al. (U.S. 20040075126A1).

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Fujiware et al. disclose a ferroelectric capacitor, which include:

Regarding claims 38 & 39, a lower metal capacitor electrode 16 (p.4 [0051]) in a reducing atmosphere that contains hydrogen impurity atoms (p.1 [0004], p.2 [0021], p.5 [0054], p.7 [0075]); annealing the lower electrode (p.5 [0053]); forming the capacitor dielectric film 30 on the metal lower electrode and forming a upper capacitor electrode 17 on the capacitive insulating film (p.4 [0051]).

Regarding claim 44, disclose wherein the capacitive insulating film is formed in An oxidizing atmosphere by MOCVD (p.6 [0063]).

Regarding claim 45, wherein crystallizing the ferroelectric film 30 on by a heat treatment before forming the upper electrode layer 17 (p.6 [0070]).

Regarding claims 46 & 48, wherein the electrode made of a lower metal capacitor Electrode made of a noble metal, or Pt (p.4 [0051]).

Regarding claim 52: wherein the capacitor insulating film is an insulating film made of an oxide by MOCVD (p.6 [0063]).

Regarding claim 55, wherein the capacitor insulating film is composed of PZT (p.4 [0051]).

Regarding claim 60, wherein the annealing process is performed at the temperature of 650 C degrees (which include the range of 450-500 C degrees) (p.5 [0053]).

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was

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made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 40 & 43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fujiwara et al. (U.S. 20040075126A1) in view of Watanabe et al. (U.S. 5,723,379).

Fujiwara et al. disclose substantially all of the claimed feature, but do not disclose wherein the annealing process is performed in an argon atmosphere contains hydrogen.

Regarding claim 40, Watanabe et al. disclose a method for fabricating a polycrystalline silicon surface, which includes the annealing lower electrode in a reducing atmosphere that contains hydrogen impurity atoms (col.5, lines 13-38, col. 5 & 6 lines 53-10, and col. 6 lines 16-24), and is performed in argon atmosphere contains hydrogen (col.11, lines 30-54 and col.12 lines 29-38).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to combine Watanabe et al.'s annealing lower electrode in a reducing atmosphere contains hydrogen impurity atoms, into the process of Fujiwara et al.'s, in order to increase the stiffness of the lower electrode by sufficient impurity taken into the lower electrode.

Fujiwara and Watanabe et al. also do not disclose wherein the metal lower electrode has a thickness of 100nm or less at the thinnest part thereof (cl.43).

Regarding claim 43, with respect to the lower electrode thickness is noted that the specification contains no disclosure of either the critical nature of the claimed thickness of any unexpected results arising there from. Where patentability is aid to be based upon particular chosen thickness or upon another variable recited in a claim, the Applicant must

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show that the chosen thickness is critical. In re Woodruff, 919 F.2d 1575, 1578, 16 USQ2d 1934, 1936 (Fed. Cir. 1990).

Furthermore, the thickness is considered to involve routine optimization while has been held to be within the level of ordinary skill in the art, As noted In re Aller 105 USPQ233, 255 (CCPA 1955). the selection of reaction parameters such as temperature and concentration would have been obvious.

Normally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these may impart patentability to a process if the particular ranges claimed produce a new and unexpected result, which is different in kind, and not merely in degree from the results of the prior art. In re Dreyfus, 22 CCPA (Patents) 830, 73 F.2d 931, 24 USPQ 52; In re Waite et al., 35CCPA (Patents) 1117, 168F.2d 104, 77 USPQ 586. Such ranges are termed "critical" ranges, and the applicant has the burden of proving such criticality. In re Swenson et al., 30 CCPA (Patents) 809, 132 F.2d 1020, 56 USPQ 372; In re Scherl, 1193, 156 F.2d, 70 USPQ 204. However, even through applicant's modification results in great improvement and utility over the prior art, it may still not be patentable if the modification was within the capabilities of one skilled in the art. In re Sola, 22 CCPS (Patents) 1313, 77 F.2d 627, 25 USQ 433; In re Normann et al., 32 CCPA (Patents) 1248, 150 F.2d 708, 66 USPQ 308; In re Irmscher, 32 CCPA (Patents) 1259, 150 F.2d 705, 66 USPQ 314. More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation. In re Swain et al. 33 CCPA (Patents) 1250, 156 F. 2d239, 70 USPQ 412; Minnesota Mining and Mfg. Co. v. Coe, 69 App. D.C. 217, 99 R.2d 986, 38 USPQ 214; Allen et al. v. Coe, 77 App. D.C 324, 135 F.2d 11, 57 USPQ 136.

Claims 47,49,50 & 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fujiwara et al. (U.S. 20040075126A1), in view of Cho et al. (U.S.6, 319,765B1).

Fujiwara et al. disclose substantially all of the claimed features, but do not disclose wherein the electrode made of a lower metal capacitor electrode made of refractory metal (cl.47), is composed of Ir (cl. 49); is composed of Ru (cl.50).

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Regarding claims 47,49 & 50, Cho disclose wherein the electrode made of a lower metal capacitor electrode made of a refractory metal, Ru, Ir or RuO<sub>2</sub>, IrO<sub>2</sub> (col.1 lines 52-57).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate Cho et al.'s lower capacitor electrode made of a refractory metal, Ru, Ir or RuO<sub>2</sub>, IrO<sub>2</sub>, into the process of Fujiwara et al., to obtain superior electrical reliability characteristics for capacitor structure in the memory device.

Fujiwara et al. also do not disclose wherein the capacitive insulating film is Composed of BST (cl.53).

Regarding claim 53, Cho et al. also disclose wherein the capacitive insulating film 26 is composed of BST (col.3 lines 66,67).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate Cho et al.'s, capacitive insulating film 26 is composed of BST, into the process of Fujiwara et al., to obtain high dielectric constant material for leakage current preventing.

Claims 41 & 42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fujiwara et al. (U.S. 20040075126A1), in view of Saida et al. (U.S. 6,146,938).



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Fujiwara et al. disclose substantially all of claimed invention, but do not disclose forming an insulating film on the substrate and forming a recess on the insulating film (cl.41); and wherein the lower electrode is formed in the recess (cl. 42)

Regarding claims 41 & 42, Saida et al. in related art disclose a method of fabricating semiconductor device having a lower electrode forming with impurity inducing into the substrate, which include an insulating film 11/13 on the substrate, then forming a recess 14 on the insulating film, and wherein the lower electrode 22 is formed in the recess (col.8 & 9, lines 62-44, fig.8).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate Saida et al.'s lower electrode in a recess that formed on an insulating film over the substrate, into the process of Fujiwara et al., to decrease the thickness of insulating film, stable capacitor structure, as well as obtain more free spaces for forming lateral other structure in the memory cell devices

Claims 51, 54 & 56-59 are rejected under 35 U.S.C. 103(a) as being unpatentable Fujiwara et al. (U.S. 20040075126A1). in view of Andricacos et al. (U.S.5, 825,609)

Fujiwara et al. disclose substantially all of claimed invention, except wherein the electrode made of Rh (cl.51).

Regarding claim 51, Andricacos et al. disclose a compound electrode stack capacitor, which include wherein the capacitor electrodes made of Rhodium (col.7, lines 1-11).

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It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate Andricacos et al.' Rhodium electrode layer, into the process of Fujiwara et al., to obtain Rhodium's superior electrical reliability characteristics.

Fujiwara et al. also do not disclose wherein the capacitor insulating is composed of SBT (cl.54); is composed of Ta<sub>2</sub>O<sub>5</sub> (cl. 56); is composed of Ta<sub>2</sub>O<sub>5</sub> wherein the lower electrode is composed of Ru (cl.57); is composed of SBT wherein the lower electrode made of Ir (cl. 58); is composed of PZT wherein the lower electrode is composed of Ir (cl.59).

Regarding claims 54 & 56-59, Andricacos et al. also disclose wherein the capacitor insulating film is an insulating film comprises of SBT, or Ta<sub>2</sub>O<sub>5</sub>, or PZT and wherein the lower electrode is alternately composed Ru or Ir (col. 7 lines 1-18).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate Andricacos et al.' capacitor insulating layer comprises of Ta<sub>2</sub>O<sub>5</sub>, PZT or SBT, into the process of Fujiwara et al., to prevent leakage current by its high dielectric constant characteristics.

### ***.Conclusion***


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Yennhu B Huynh whose telephone number is 571-272-1692. The examiner can normally be reached on 8.30AM-7.00PM.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached on 571-272-1702. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-7724.

YNBH,  
7/23/04

  
CARL WHITEHEAD, JR.  
SUPERVISORY PATENT EXAMINER  
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